

WHAT IS CLAIMED IS:

1. A secondary air supply apparatus for an internal combustion engine provided with plural cylinders, which supplies secondary air to a portion upstream of an exhaust
5 gas control device, characterized by comprising:
- an air pump which supplies air under pressure;
 - a first air passage through which the air delivered under pressure from the air pump flows;
 - a first opening/closing valve which opens/closes the first air passage;
 - 10 a second air passage whose one end is connected to the first air passage at a portion downstream of the first opening/closing valve, and whose other end is connected to an exhaust passage leading to a predetermined cylinder among the plural cylinders;
 - a second opening/closing valve which opens/closes the second air passage;
 - a third air passage whose one end is connected to the first air passage at a
15 portion downstream of the first opening/closing valve, and whose other end is connected to an exhaust passage leading to a cylinder different from the predetermined cylinder to which the exhaust passage connected to the second air passage leads;
 - a third opening/closing valve which opens/closes the third air passage;
 - a pressure detector that performs detection of a pressure in the first air passage,
20 the pressure detector being provided between the air pump and the first opening/closing valve; and
 - a failure determining device that determines whether failure has occurred in the secondary air supply apparatus based on a result of the detection that is performed by the pressure detector while the first opening/closing valve is controlled so as to be opened,
25 the second opening/closing valve and the third opening/closing valve are controlled so as to be closed, and the air pump is controlled so as to be stopped.

2. The secondary air supply apparatus according to claim 1, characterized in that the failure determining device determines whether failure has occurred in the secondary

air supply apparatus when an amount of air introduced into the internal combustion engine is larger than a predetermined amount.

3. The secondary air supply apparatus according to claim 1 or 2, characterized in
5 that the failure determining device determines that failure has occurred in the secondary air supply apparatus when a change in the pressure is detected by the pressure detector.

4. The secondary air supply apparatus according to any one of claims 1 to 3,
characterized in that the failure determining device determines whether failure has
10 occurred in at least one of the second opening/closing valve and the third opening/closing valve.

5. A secondary air supply apparatus for an internal combustion engine installed
in a vehicle, which supplies secondary air to a portion upstream of an exhaust gas control
15 device, characterized by comprising:

a pressure detector that performs detection of a pressure of secondary air
delivered under pressure from an air pump to a passage connecting to an exhaust gas
passage;

an information obtaining device that obtains information relating to noise heard
20 by an occupant of the vehicle;

a pump operating device that operates the air pump when a magnitude of the
noise is larger than a predetermined value; and

a failure determining device that determines whether failure has occurred in the
secondary air supply apparatus based on a result of the detection that is performed by the
25 pressure detector while the air pump is controlled so as to be operated.

6. The secondary air supply apparatus according to claim 5, characterized in that
the information relating to the noise includes at least one of a vehicle speed, a rotational
speed of the internal combustion engine, and an opening amount of a throttle valve

provided in the internal combustion engine.

7. The secondary air supply apparatus according to claim 4 or 5, wherein the internal combustion engine is provided with plural cylinders, characterized in that

5 the secondary air supply apparatus includes i) a first air passage through which the air delivered under pressure from the air pump flows, ii) a first opening/closing valve which opens/closes the first air passage, iii) a second air passage which is connected to the first air passage at a portion downstream of the first opening/closing valve, and which is connected to an exhaust passage leading to a predetermined cylinder among the plural
10 cylinders, iv) a second opening/closing valve which opens/closes the second air passage, v) a third air passage which is connected to the first air passage at a portion downstream of the first opening/closing valve, and which is connected to an exhaust passage leading to a cylinder different from the predetermined cylinder to which the exhaust passage connected to the second air passage leads, and vi) a third opening/closing valve which
15 opens/closes the third air passage; and

 the failure determining device determines whether failure has occurred in the secondary air supply apparatus based on a result of the detection that is performed by the pressure detector while the first opening/closing valve, the second opening/closing valve, and the third opening/closing valve are controlled so as to be closed.

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8. The secondary air supply apparatus according to claim 7, characterized in that the failure determining device determines that failure has occurred in the secondary air supply apparatus when an increase in the pressure is not detected by the pressure detector.

25 9. The secondary air supply apparatus according to any one of claims 5 to 8, characterized in that the failure determining device determines whether failure has occurred in at least one of the pressure detector and the air pump.

10. A secondary air supply method for controlling secondary air supplied to a

portion upstream of an exhaust gas control device, characterized by comprising:

providing with an air pump which supplies air under pressure; a first opening/closing valve which opens/closes the first air passage through which the air delivered under pressure from the air pump flows; a second opening/closing valve
5 which opens/closes the second air passage which is connected to the first air passage at a portion downstream of the first opening/closing valve, and which is connected to an exhaust passage leading to a predetermined cylinder among the plural cylinders; and a third opening/closing valve which opens/closes the third air passage which is connected to the first air passage at a portion downstream of the first
10 opening/closing valve, and which is connected to an exhaust passage leading to a cylinder different from the predetermined cylinder to which the exhaust passage connected to the second air passage leads;

detecting a pressure in the first air passage between the air pump and the first opening/closing valve; and
15 determining whether failure has occurred in the secondary air supply apparatus based on a result of the detection that is performed by the pressure detector while the first opening/closing valve is controlled so as to be opened, the second opening/closing valve and the third opening/closing valve are controlled so as to be closed, and the air pump is controlled so as to be stopped.

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11. A secondary air supply apparatus for controlling secondary air supplied to a portion upstream of an exhaust gas control device, characterized by comprising:

detecting a pressure of air delivered under pressure from an air pump;
obtaining information relating to noise heard by an occupant of the vehicle;
25 a pump operating device which operates the air pump when a magnitude of the noise is larger than a predetermined value; and
determining whether failure has occurred in the secondary air supply apparatus based on the detected pressure while the air pump is controlled so as to be operated.